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## ABBREVIATIONS, SIGNS, AND SYMBOLS

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**A**BBREVIATIONS SAVE SPACE and prevent the distraction of needlessly repeated words or phrases. The space saved is usually so small, however, that the use of abbreviations is determined largely by custom, convenience to the reader, and the appearance of the printed page.

In general, few abbreviations should be used in the text of a Survey report, although many may be used in tables and footnotes. The text should be understandable by nonspecialists, and abbreviations should be used without definition only if they are widely understood (for example, such common bibliographic abbreviations as “fig.,” “pl.,” “p.,” and “no.,” and other nonbibliographic abbreviations such as “a.m.,” “p.m.,” “A.D.,” and “B.C.”).

Uncommon abbreviations must be defined the first time they are used in the main text. The standard Survey format is to enclose the abbreviated form in parentheses immediately following the spelled out form—for example, U.S. Geological Survey (USGS). Follow the same procedure in the abstract if a term is used several times there, and because the abstract must be able to stand alone, repeat the procedure in the main text the first time the abbreviation is used there.

Common sense can help decide when abbreviations are appropriate. Terms used only a few times should not be abbreviated, and abbreviations that might inconvenience the reader should not be used. In general, abbreviations are suitable for often-repeated names of organizations, conferences, congresses, and programs—for example, IGCP, for International Geological Correlation Programme; AGI, for American Geological Institute; also, for widely used instruments or processes—for example, SEM for scanning-electron microscope. Abbreviations are inappropriate for geographic names or geologic terms in Survey reports, no matter how many times such names or terms are used in a paper. Do not, for example, use AB for Appalachian Basin, SAF for San Andreas Fault, or MVTD for Mississippi Valley-type deposits.

Abbreviations are used freely in tables, partly because of tight space limitations. Abbreviations used in tables are defined in bracketed headnotes.

In general, abbreviations for scientific terms and for terms of measurement are not followed by periods; however, a period should be used with the abbreviation for “inch(es)” if the abbreviation might be con-

fused with the preposition “in.” A better procedure is to just spell out the word “inch(es).”

### NAMES OF COUNTRIES AND OTHER POLITICAL SUBDIVISIONS

“U.S.” is used when “United States” precedes the word “Government” or the name of a Government organization: U.S. Government, U.S. Congress, U.S. Department of the Interior, U.S. Geological Survey. No spaces are left between the letters and periods of “U.S.,” but a space precedes the name that follows. In titles, “United States” should be written out whether it is a noun or an adjective. In the text, “United States” should be written out when used as a noun and abbreviated when used as an adjective—for example, “mineral deposits of the United States,” *but* “U.S. mineral deposits.”

Names of foreign countries, except that of the U.S.S.R. (or SSSR), are not abbreviated, nor are the names of their political subdivisions. “United States” is written out when used in association with the names of other countries, except the U.S.S.R.; thus, British, French, and United States Governments; United States-British talks; *but* U.S.-U.S.S.R. meeting.

### STATES AND POSSESSIONS OF THE UNITED STATES

Names of States of the United States (except Alaska, Hawaii, Idaho, Iowa, Maine, Ohio, and Utah), also the District of Columbia, Puerto Rico, and the Virgin Islands, are abbreviated when they immediately follow a capitalized geographic term; they are spelled out after a lowercased word: Chicago, Ill.; Montgomery County, Md.; Stone Mountain, Ga.; Arlington National Cemetery, Va.; Redstone Arsenal, Ala.; *but* St. Lawrence County magnetite district, New York; Tacoma area, Washington. The names of other insular possessions, trust territories, and such places as Long Island and Staten Island are not abbreviated. Customary abbreviations are used for States in reports; Postal Service abbreviations are used only in “ZIP code” mailing addresses.

<i>States and possessions</i>	<i>Customary abbreviations</i>	<i>Postal Service abbreviations</i>	<i>States and possessions</i>	<i>Customary abbreviations</i>	<i>Postal Service abbreviations</i>	<i>States and possessions</i>	<i>Customary abbreviations</i>	<i>Postal Service abbreviations</i>
Alabama-----	Ala.	AL	Maryland-----	Md.	MD	Rhode Island-----	R.I.	RI
Alaska-----	Alaska	AK	Massachusetts-----	Mass.	MA	South Carolina-----	S.C.	SC
Arizona-----	Ariz.	AZ	Michigan-----	Mich.	MI	South Dakota-----	S. Dak.	SD
Arkansas-----	Ark.	AR	Minnesota-----	Minn.	MN	Tennessee-----	Tenn.	TN
California-----	Calif.	CA	Mississippi-----	Miss.	MS	Texas-----	Tex.	TX
Colorado-----	Colo.	CO	Missouri-----	Mo.	MO	Utah-----	Utah	UT
Connecticut-----	Conn.	CT	Montana-----	Mont.	MT	Vermont-----	Vt.	VT
Delaware-----	Del.	DE	Nebraska-----	Nebr.	NE	Virginia-----	Va.	VA
Florida-----	Fla.	FL	Nevada-----	Nev.	NV	Washington-----	Wash.	WA
Georgia-----	Ga.	GA	New Hampshire-----	N.H.	NH	West Virginia-----	W. Va.	WV
Hawaii-----	Hawaii	HI	New Jersey-----	N.J.	NJ	Wisconsin-----	Wis.	WI
Idaho-----	Idaho	ID	New Mexico-----	N. Mex.	NM	Wyoming-----	Wyo.	WY
Illinois-----	Ill.	IL	New York-----	N.Y.	NY			
Indiana-----	Ind.	IN	North Carolina-----	N.C.	NC	District of		
Iowa-----	Iowa	IA	North Dakota-----	N. Dak.	ND	Columbia-----	D.C.	DC
Kansas-----	Kans.	KS	Ohio-----	Ohio	OH	Guam-----	Guam	GU
Kentucky-----	Ky.	KY	Oklahoma-----	Okla.	OK	Puerto Rico-----	P.R.	PR
Louisiana-----	La.	LA	Oregon-----	Oreg.	OR	Virgin Islands-----	V.I.	VI
Maine-----	Maine	ME	Pennsylvania-----	Pa.	PA			

## ACCENTS AND DIACRITICAL MARKS

In Survey publications accents and diacritical marks are used chiefly in the spelling of foreign words. Take care to use them correctly:

- ˊ acute (Orléans)
- ° bolle (Ålesund)
- ˘ cedilla (français)
- ˆ circumflex (côte)
- ¨ dieresis or umlaut (Nürnberg)
- ˋ grave (Asmères)
- ˇ hacek (Příbyl)
- ˆ inverted cedilla (Dąbrowa)
- ˉ macron (Kyūshu)
- / slash (Rømros)
- ˊ soft sign (Arkhangel'sk)
- ˙ superior dot (szarżysko Kamienna)
- ˜ tilde (cañon)

## ADDRESSES

The words "street," "avenue," "building," and similar address terms following a name or number are abbreviated in footnotes, tables, leaderwork, and lists, but as parts of names, they are spelled out, even in parentheses, footnotes, tables, and leaderwork: "2912 14th St.," *but* "14th Street Bridge." The words "county," "fort," "mount," "point," and "port" are not abbreviated. "Saint (St.)" and "Sainte (Ste.)" should be abbreviated.

## CHEMICAL ELEMENTS, NAMES, AND SYMBOLS

Chemical names, rather than symbols, should generally be used in text, as discussed in "Chemical

Terminology." Names and symbols are given in table 2.

## DATES

Names of months followed by the day, or by the day and year, are usually abbreviated in tables, locality lists, and in parentheses. May, June, and July are always spelled out. Preferred forms for other months are as follows:

Jan.	Apr.	Oct.
Feb.	Aug.	Nov.
Mar.	Sept.	Dec.

In narrow columns of tables, the names of months may be abbreviated even if they stand alone. Otherwise, the form used in Survey reports is "January 1, 1985."

## GEOCHRONOLOGIC DATING

Article 13 of the North American Stratigraphic Code (North American Commission on Stratigraphic Nomenclature, 1983), quoted in part below, should be followed for the preferred abbreviations used in geochronologic dating.

The "present" refers to 1950 AD [sic], and such qualifiers as "ago" or "before the present" are omitted after the value because measurement of the duration from the present to the past is implicit in the designation. In contrast, the duration of a remote interval of geologic time, as a number of years, should not be expressed by the same symbols. Abbreviations for numbers of years, without reference to the present, are informal (e.g., y or yr for years; my, m.y., or m.yr. for millions of years; and so forth, as preference dictates). For example, boundaries of the Late Cretaceous Epoch currently are calibrated at 63 Ma and 96 Ma, but the interval of time represented by this epoch is 33 m.y.

**Table 2.** Chemical symbols

[The names and symbols listed below are approved by the International Union of Pure and Applied Chemistry. From the U.S. GPO Style Manual, 1984, p. 157]

Element	Sym- bol	Atomic num- ber <sup>1</sup>	Atomic weight	Element	Sym- bol	Atomic num- ber <sup>1</sup>	Atomic weight
Actinium .....	Ac	89	227.0278	Molybdenum.....	Mo	42	95.94
Aluminium .....	Al	13	26.98154	Neodymium .....	Nd	60	144.24
Americium .....	Am	95	(243)	Neon.....	Ne	10	20.179
Antimony .....	Sb	51	121.75	Neptunium.....	Np	93	237.0482
(Stibium).							
Argon .....	Ar	18	39.948	Nickel .....	Ni	28	58.69
Arsenic .....	As	33	74.9216	Niobium.....	Nb	41	92.9064
Astatine.....	At	85	(210)	Nitrogen .....	N	7	14.0067
Barium.....	Ba	56	137.33	Nobelium.....	No	102	(259)
Berkelium.....	Bk	97	(247)	Osmium .....	Os	76	190.2
Beryllium.....	Be	4	9.01218	Oxygen.....	O	8	15.9994
Bismuth.....	Bi	83	208.9804	Palladium.....	Pd	46	106.42
Boron .....	B	5	10.81	Phosphorus .....	P	15	30.97376
Bromine.....	Br	35	79.904	Platinum .....	Pt	78	195.08
Cadmium.....	Cd	48	112.41	Plutonium.....	Pu	94	(244)
Caesium.....	Cs	55	132.9054	Polonium.....	Po	84	(209)
Calcium .....	Ca	20	40.08	Potassium .....	K	19	39.0983
				(Kalium).			
Californium .....	Cf	98	(251)	Praseodymium ...	Pr	59	140.9077
Carbon .....	C	6	12.011	Promethium .....	Pm	61	(145)
Cerium.....	Ce	58	140.12	Protactinium .....	Pa	91	231.0359
Chlorine.....	Cl	17	35.453	Radium .....	Ra	88	226.0254
Chromium.....	Cr	24	51.996	Radon.....	Rn	86	(222)
Cobalt.....	Co	27	58.9332	Rhenium.....	Re	75	186.207
Copper.....	Cu	29	63.546	Rhodium.....	Rh	45	102.9055
Curium .....	Cm	96	(247)	Rubidium .....	Rb	37	85.4678
Dysprosium.....	Dy	66	162.50	Ruthenium.....	Ru	44	101.07
Einsteinium.....	Es	99	(252)	Samarium .....	Sm	62	150.36
Erbium.....	Er	68	167.26	Scandium.....	Sc	21	44.9559
Europium.....	Eu	63	151.96	Selenium .....	Se	34	78.96
Fermium.....	Fm	100	(257)	Silicon .....	Si	14	28.0855
Fluorine.....	F	9	18.998403	Silver.....	Ag	47	107.8682
Francium.....	Fr	87	(223)	Sodium .....	Na	11	22.98977
				(Natrium).			
Gadolinium.....	Gd	64	157.25	Strontium.....	Sr	38	87.62
Gallium .....	Ga	31	69.72	Sulfur.....	S	16	32.06
Germanium.....	Ge	32	72.59	Tantalum .....	Ta	73	180.9479
Gold.....	Au	79	196.9665	Technetium.....	Tc	43	(98)
Hafnium.....	Hf	72	178.49	Tellurium.....	Te	52	127.60
Helium.....	He	2	4.00260	Terbium.....	Tb	65	158.9254
Holmium.....	Ho	67	164.9304	Thallium .....	Tl	81	204.383
Hydrogen.....	H	1	1.00794	Thorium .....	Th	90	232.0381
Indium.....	In	49	114.82	Thulium.....	Tm	69	168.9342
Iodine.....	I	53	126.9045	Tin.....	Sn	50	118.69
Iridium .....	Ir	77	192.22	Titanium .....	Ti	22	47.88
Iron.....	Fe	26	55.847	Tungsten .....	W	74	183.85
				(Wolfram).			
Krypton .....	Kr	36	83.80	(Unnilhexium)....	(Unh)	106	(263)
Lanthanum.....	La	57	138.9055	(Unnilpentium)...	(Unp)	105	(262)
Lawrencium.....	Lr	103	(260)	(Unnilquadium)...	(Unq)	104	(261)
Lead .....	Pb	82	207.2	Uranium.....	U	92	238.0289
Lithium .....	Li	3	6.941	Vanadium .....	V	23	50.9415
Lutetium .....	Lu	71	174.967	Xenon.....	Xe	54	131.29
Magnesium.....	Mg	12	24.305	Ytterbium.....	Yb	70	173.04
Manganese.....	Mn	25	54.9380	Yttrium .....	Y	39	88.9059
Mendelveium.....	Md	101	(258)	Zinc .....	Zn	30	65.38
Mercury.....	Hg	80	200.59	Zirconium.....	Zr	40	91.22

<sup>1</sup> The atomic weights of many elements are not invariant but depend on the origin and treatment of the material. The values of atomic weight given here apply to elements as they exist naturally on Earth and to certain artificial elements. Values in parentheses are used for radioactive elements whose atomic weights cannot be quoted precisely without knowledge of the origin of the elements. The value given is the atomic mass number of the isotope of that element of longest known half life.

For dating use the following:

ka for kilo-annum ( $10^3$  years)  
Ma for mega-annum ( $10^6$  years)  
Ga for giga-annum ( $10^9$  years)

Note that ka and kilo are not capitalized (by international convention).

## LAND

In describing land divisions subdivided by section, township, and range, use the following forms (omit periods after abbreviated compass directions that immediately precede and close up on figures):

SE $\frac{1}{4}$ NW $\frac{1}{4}$  sec. 4, T. 12 S., R. 15 E., of the Boise Meridian  
lot 6, NE $\frac{1}{4}$  sec. 4, T. 6 N., R. 1 W.  
N $\frac{1}{2}$  sec. 20, T. 7 N., R. 2 W., Sixth Principal Meridian  
Tps. 9, 10, 11, and 12 S., Rs. 12 and 13 W.  
T. 2 S., Rs. 8, 9, and 10 E., sec. 26  
T. 3 S., R. 1 E., sec. 34, W $\frac{1}{2}$ E $\frac{1}{2}$ , W $\frac{1}{2}$ , and W $\frac{1}{2}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 32 (with or without a township number)

If fractions are spelled out in land descriptions, "half" and "quarter" are used (not "one-half" or "one-quarter"): "south half of T. 47 N., R. 64 E." Avoid breaking a group such as NE $\frac{1}{4}$ SE $\frac{1}{4}$  sec. 4 at the end of a line. If a break is unavoidable, make it after the fraction and use no hyphen.

## LATITUDE AND LONGITUDE

The words "latitude" and "longitude" followed by figures are abbreviated (no periods after "lat" and "long"), and the figures are closed up: lat 52°33'05"N., long 13°21'10"E. Avoid breaking latitude and longitude figures at the end of a line. If a break is unavoidable, use a hyphen.

## MEASUREMENTS

Terms denoting units of measurement should be abbreviated only when preceded by an amount indicated in numerals. Thus, write "3 m high," "6 cm thick," *but* "several meters long," "a few kilometers north."

Over a stratigraphic figure column, use "Meters," "(m)," "Feet," "(feet)," "Ft In," or "(ft in)," depending on the content of the column, whether the term stands by itself or follows another term such as

"Thickness," and depending on the amount of space available.

## MINERALS

Mineral names are not ordinarily abbreviated in narrative text, but abbreviations may be appropriate on certain maps, in tables, or as symbols, subscripts, or superscripts. Symbols for common minerals are given in table 3.

## NAMES AND TITLES

In the names of business firms, the abbreviated forms "Bros.," "Co.," "Corp.," "Inc.," "Ltd.," and "&" should be used if the full legal title need not be preserved. "Company" and "Corporation" are not abbreviated in names of Federal Government units. "Association" and "Manufacturing" are not abbreviated.

Names of railroads should not be abbreviated except in parentheses, footnotes, tables, and leaderwork. Use the correct form "Railroad" or "Railway" ("RR." and "Ry."), depending on the usage of the individual company.

In other than formal usage, a civil, military, or naval title preceding a name is abbreviated if followed by a given name or initials: "Col. H.M. Smith furnished data on the wells"; *but* "Colonel Smith furnished \* \* \*." The titles "Senator" and "Representative" are not abbreviated.

## NUMBER

The abbreviation "no." (lowercase "n") is used for serial numbers and in citing "v." and "no." of a publication: "Journal of Paleontology, v. 10, no. 3." In identifying specimens, wells, drill holes, and the like, however, "number" or "No." is generally superfluous and can be omitted: "specimen 4297," "Government well 6W," "Drill hole 5" *but* "Of all the specimens examined, No. 4297 most clearly illustrated \* \* \*." Do not use the symbol #. Uppercase "N" is used in formal names and in numbered coal beds.

## PERCENT

The word "percent" should be spelled out in text. In tables, the abbreviation "pct" or the symbol "%" may be used if other terms of measurement are also abbreviated. The symbol "%", however, is not as easily read in small type. "Percent" should be used with numerals: "20 percent." It is preferred to "percentage" for table headings. "Percentage"

**Table 3. Mineral symbols**

[Kretz, 1983; courtesy of the Mineralogical Society of America]

Acm	acmite	Elb	elbaite	Ntr	natrolite
Act	actinolite	En	enstatite (ortho)	Ne	nepheline
Agt	aegirine-augite	Ep	epidote	Nrb	norbergite
Ak	åkermanite	Fst	fassaite	Nsn	nosean
Ab	albite	Fa	fayalite	Ol	olivine
Aln	allanite	Fac	ferroactinolite	Omp	omphacite
Alm	almandine	Fed	ferroedenite	Oam	orthoamphibole
Anl	analcime	Fs	ferrosilite (ortho)	Or	orthoclase
Ant	anatase	Fts	ferrotschermakite	Opx	orthopyroxene
And	andalusite	Fl	fluorite	Pg	paragonite
Adr	andradite	Fo	forsterite	Prg	pargasite
Anh	anhydrite	Gn	galena	Pct	pectolite
Ank	ankerite	Grt	garnet	Pn	pentlandite
Ann	annite	Ged	gedrite	Per	periclase
An	anorthite	Gh	gehlenite	Prv	perovskite
Atg	antigorite	Gbs	gibbsite	Phl	phlogopite
Ath	anthophyllite	Glt	glauconite	Pgt	pigeonite
Ap	apatite	Gln	glaucophane	Pl	plagioclase
Apo	apophyllite	Gt	goethite	Prh	prehnite
Arg	aragonite	Gr	graphite	Pen	protoenstatite
Arf	arfvedsonite	Grs	grossular	Pmp	pumpellyite
Apy	arsenopyrite	Gru	grunerite	Py	pyrite
Aug	augite	Gp	gypsum	Prp	pyrope
Ax	axinite	Hl	halite	Prl	pyrophyllite
Brt	barite	Hs	hastingsite	Po	pyrrhotite
Brl	beryl	Hyn	hauyne	Qtz	quartz
Bt	biotite	Hd	hedenbergite	Rbk	riebeckite
Bhm	boehmite	Hem	hematite	Rds	rhodochrosite
Bn	bornite	Hc	hercynite	Rdn	rhodonite
Brk	brookite	Hul	heulandite	Rt	rutile
Brc	brucite	Hbl	hornblende	Sa	sanidine
Bst	bustamite	Hu	humite	Spr	sapphirine
Cam	Ca clin amphibole	Ill	illite	Scp	scapolite
Cpx	Ca clinopyroxene	Ilm	ilmenite	Srl	schorl
Cal	calcite	Jd	jadeite	Srp	serpentine
Ccn	cancrinite	Jh	johannsenite	Sd	siderite
Crn	carnegieite	Krs	kaersutite	Sil	sillimanite
Cst	cassiterite	Kls	kalsilite	Sdl	sodalite
Cls	celestite	Kln	kaolinite	Sps	spessartine
Cbz	chabazite	Ktp	kataphorite	Sp	sphalerite
Cc	chalcocite	Kfs	K feldspar	Spl	spinel
Ccp	chalcopyrite	Krn	kornorupine	Spd	spodumene
Chl	chlorite	Ky	kyanite	St	staurolite
Cld	chloritoid	Lmt	laumontite	Stb	stilbite
Chn	chondrodite	Lws	lawsonite	Stp	stilpnomelane
Chr	chromite	Lpd	lepidolite	Str	strontianite
Ccl	chrysocolla	Lct	leucite	Tlc	talc
Ctl	chrysotile	Lm	limonite		
Cen	clinoenstatite	Lz	lizardite	Tms	thomsonite
Cfs	clinoferrosilite	Lo	loellingite	Ttn	titanite
Chu	clinohumite	Mgh	maghemite	Toz	topaz
Czo	clinozoisite	Mkt	magnesiokataphorite	Tur	tourmaline
Crđ	cordierite	Mrb	magnesianriebeckite	Tr	tremolite
Crn	corundum	Mgs	magnesite	Trd	tridymite
Cv	covellite	Mag	magnetite	Tro	troilite
Crs	cristobalite	Mrg	margarite	Ts	tschermakite
Cum	cummingtonite	Mel	melilite	Usp	ulvöspinel
Dsp	diaspore	Mc	microcline	Vrm	vermiculite
Dg	digenite	Mo	molybdenite	Ves	vesuvianite
Di	diopside	Mnz	monazite	Wth	witherite
Dol	dolomite	Mtc	monticellite	Wo	wollastonite
Drv	dravite	Mnt	montmorillonite	Wus	wüstite
Eck	eckermannite	Mul	mullite	Zrn	zircon
Ed	edenite	Ms	muscovite	Zo	zoisite

(synonymous with “proportion”) may be used in such phrases as “a small percentage” when proportion is meant. When proportion is not meant, an expression such as “a small part” should be used. “Percentage” may be used with numerals in a phrase such as “5 percentage points.”

## ROCKS

The names of rocks are never abbreviated in narrative text, but abbreviations may be appropriate on certain maps or tables; uniformity in such usage is desirable. Unusual abbreviations must be defined to

avoid misunderstandings. Common abbreviations are given on page 55.

## TEMPERATURE

Temperature is expressed in figures. Following the practice of the American Society for Testing and Materials "Standard for Metric Practice," STA recommends no space before or after the degree sign ( $100^{\circ}\text{C}$ ,  $212^{\circ}\text{F}$ ).

## TERMS OF DIRECTION

Terms of direction are spelled out in text: "Kanosh is 58 km northwest of Koosharem; both are north of Kanab." In expressions of dip and strike, the terms of direction are abbreviated, and the degree mark is set without space against the figures:

A dip of  $10^{\circ}$  SE. (or  $10^{\circ}$  S.  $35^{\circ}$  E.)  
The strike is N.  $55^{\circ}$  E. (or N.  $45^{\circ}$ – $70^{\circ}$  E.)  
N.  $55^{\circ}30'25''$  E.  
*but* "the dip is southeast."

Abbreviated terms of direction are followed by a period:

N., S., NW., SE., NNW., ESE.

## COMMON WORD ABBREVIATIONS

The following abbreviations are commonly used in parenthetical phrases, brackets, footnotes, sidenotes, synonymies, tables, and leaderwork:

abstract(s), abs.	hydrologic(al), hydrol.
annual, ann.	illustration(s), illus.
appendix, app.	investigation(s), inv.
approximate(ly), approx.	locality, loc.
article(s), art., arts.	miscellaneous, misc.
association, assoc.	Mount, Mt.
biologic(al), biol.	page(s), p.
bulletin, bull.	part(s), pt., pts.
chapter, chap.	plate(s), pl., pls.
chemical, chem.	publication(s), pub., pubs.
communication(s), commun.	report(s), rept., repts.
edition, editor(s), ed., eds.	science(s), sci.
figure(s), fig., figs.	section(s), sec., secs.
formation(s), fm., fms.	series, ser.
geographic(al), geog.	stratigraphic(al), strat.
geologic(al), geol.	topographic(al), topog.
geophysical, geophys.	volume, v.
hydrographic, hydrog.	zoologic(al), zool.

## SCIENTIFIC AND ENGINEERING TERMS

Table 4 lists abbreviations, signs, and symbols for scientific and engineering terms likely to be used in Survey reports. Cite meanings in text or appendix. The exact form and style of some symbols may vary with different printers.

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms

[Adapted from lists in STA5 and STA6. For further treatment of abbreviations, see U.S. GPO Style Manual, 1984, chap. 9. For abbreviations on maps, see p. 55; for minerals and normative minerals, see p. 108; for chemical elements, see p. 106]

absolute .....	abs
absolute value .....	
absorbance .....	A
absorptivity .....	a
absorptivity, molar .....	$\epsilon$
acceleration, angular .....	$\alpha$
acceleration, linear .....	a
acre-foot (feet) .....	acre-ft
activity, chemical (absolute) .....	$\lambda$
activity, chemical (relative) .....	a
activity coefficient .....	$\gamma$
affinis .....	aff.
alternating current .....	ac or $\lessgtr$ or $\rightleftharpoons$
alternating-current (unit modifier) .....	a-c
altitude .....	alt
ampere .....	A
analytical variability .....	$\xi_a$
angle .....	$\angle$
angle between .....	$\wedge$
angle between $a_0$ and $b_0$ in the unit cell .....	$\gamma$
angle between $a_0$ and $c_0$ in the unit cell .....	$\beta$
angle between $b_0$ and $c_0$ in the unit cell .....	$\alpha$
angle between the two optic axes of a biaxial mineral .....	2V
angstrom .....	$\text{\AA}$
angular frequency .....	$\omega$
angular velocity .....	$\omega$
anhydrous .....	anhyd
antilogarithm .....	antilog
approaches .....	$\rightarrow$
approximate (tion of) .....	approx
approximately (nearly) equal to .....	$\approx$
aqueous .....	aq
are (land area) .....	a
area .....	A or S
astronomical unit (in English) .....	au
asymptotically equal to .....	$\approx$
atmosphere .....	atm
atomic mass .....	$m_a$ or $m$

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

atomic mass of species X .....	$m(X)$ or $m_x$
atomic number .....	at. no. or $Z$
atomic number of species X .....	$Z(X)$ or $Z_x$
atomic weight .....	at. wt. or $M$
atomic weight of species X .....	$M(X)$ or $M_x$
automatic data processing .....	ADP
average .....	avg
average (indicated by bar or vinculum over symbol or by angular parentheses) .....	— or $\langle \rangle$
Avogadro's number .....	$N$ or $N_A$
avoirdupois .....	avdp
azimuth .....	az or $\alpha$
barn (area) .....	b
barometer .....	bar.
barrel .....	barrel
barrel per day .....	barrel/d
base of natural logarithms .....	e
baud .....	Bd
Baumé (used with degree symbol) .....	°Bé
becquerel .....	Bq
before present (dates before 1950, in thousands of years) .....	B.P.
bench mark (in illustrations) .....	BM
bench mark (in text) .....	B.M.
Bernoulli number .....	$B$
Bessel function (first kind, zero order) .....	$J_0(x)$
Bessel function, hyperbolic (first kind, zero order) .....	$I_0(x)$
bias .....	$\delta$
billion gallons per day .....	Ggal/d
billion years .....	b.y.
binary coded decimal .....	BCD
biochemical oxygen demand .....	BOD
bit, byte .....	b
Bohr magneton .....	$\mu_B$
boiling point .....	bp
Boltzmann constant .....	$k$
Boltzmann function .....	$H$
bottom-withdrawal tube .....	BW-tube
braces .....	{ }
brackets .....	[ ]
Bragg angle, glancing angle ( $2\theta$ is twice the glancing angle in X-ray diffraction) .....	$\theta$
breadth (width) .....	$b$ or $B$
Brinell hardness number .....	Bhn
British thermal unit .....	Btu
bushel .....	bu
byte .....	B
calculated .....	calc
calorie .....	cal
candela .....	cd
candela-hour .....	c-h

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

capacitance .....	$C$
carat .....	kt
Cartesian coordinates .....	$x, y, z$
cathode ray .....	CR
cathode-ray tube .....	CRT
Celsius (used with degree symbol) .....	°C
centimeter .....	cm
centimeter-gram-second (system) .....	CGS
centimeter-gram-second (unit) .....	cgs
central processing unit .....	CPU
chemical oxygen demand .....	COD
chemical potential .....	$\mu$
chi-square statistic .....	$\chi^2$
circa (about) .....	ca.
circle .....	$\bigcirc$
circular (shape) .....	circ
citrate-extractable heavy metal .....	cxHM
coefficient .....	coef
cold-extractable copper .....	cxCu
collection(s) (abbreviation used only with numbers) .....	colln(s).
cologarithm .....	colog
compressibility .....	$\kappa$
concentrate .....	conc
concentrated .....	concd
concentration .....	concn or $c$
conductance .....	$G$
conductivity .....	$\gamma$
confer (to be compared to) .....	cf.
confidence limit, lower, for the population mean .....	$\mu_L$
confidence limit, upper, for the population mean .....	$\mu_U$
constant .....	const
constant as defined in text .....	$K$
continued (abbreviation used only in some tables) .....	con.
Coordinated Universal Time .....	UTC
corner .....	cor.
correlation coefficient .....	$\rho$ or $r$
cosecant .....	csc
cosecant, hyperbolic .....	csch
cosine .....	cos
cosine, hyperbolic .....	cosh
cotangent .....	cot
cotangent, hyperbolic .....	coth
coulomb .....	C
counts per minute .....	c/min
critical .....	crit
Cross, Iddings, Pirsson, and Washington .....	CIPW
cross section of atoms and nuclei .....	$\sigma$
crystallographic axes .....	$a, b, c$
cubic centimeter .....	cm <sup>3</sup>

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

cumulative frequency .....	c.f.
curie .....	Ci
cutting point in a hypothesis test .....	$\Omega$
cycle (radio) .....	c
cycles per minute .....	c/min
cycles per second .....	c/s
cylinder .....	cyl
darcy, darcies .....	D
day .....	d
debye unit .....	D
decay constant .....	$\lambda$
decay constant based on alpha emission .....	$\lambda_a$
decay constant based on negative beta emission ...	$\lambda_{\beta^-}$
decay constant based on orbital electron capture .....	$\lambda_e$ or $\lambda_{EC}$
decay constant based on positron emission .....	$\lambda_{\beta^+}$
decay constant based on spontaneous fission .....	$\lambda_{SF}$
decibel .....	dB
degree .....	°
degree Celsius .....	°C
degree Fahrenheit .....	°F
degree Rankine .....	°R
degree réamur .....	°R
degrees of freedom .....	d.f.
delta (finite change, incremental variations, difference) .....	$\Delta$ or $\delta$
density (mass) .....	$\rho$
density (relative) .....	$d$
depth .....	$h$
deuterium .....	D or $^2\text{H}$
deuteron .....	d
diameter .....	diam, $D$ , or $d$
dielectric constant (permittivity) .....	$\epsilon$
dielectric flux .....	$\Psi$
differential, partial .....	$\partial$
differential thermoanalysis .....	dta
differential, total .....	d or $d$
dilute .....	dil
direct current .....	dc or $\rightarrow$
direction of extraordinary ray .....	E
direction of flow .....	$\rightarrow$
direction of ordinary ray .....	O
discharge; total water discharge; rate of discharge; recharge .....	Q
disintegrations per minute .....	d/min
disintegrations per second .....	d/s
disk operating system .....	DOS
dissociation constant .....	K
dissociation constant, negative logarithm of; -log K .....	pK
dissolved oxygen .....	DO
dissolved solids .....	DS
distilled .....	dist

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

ditto (the same) .....	do.
divided by .....	$\div$
dozen .....	doz
dram .....	dr
dropping mercury electrode .....	dme
dry basis .....	DB
dyne .....	dyn
efficiency .....	eff
electric current .....	$I$
electric-current density .....	$J, j$
electric-field strength .....	$E$
electric potential .....	$V$
electromagnetic unit .....	emu
electromotive force .....	emf or $E'$
electron .....	e or $e$
electron mass .....	$m_e$
electron-spin resonance .....	esr
electronvolt .....	eV
electrostatic flux .....	$\Psi$
electrostatic unit .....	esu
elementary charge .....	$e$
elevation .....	elev
emendatio (emended) .....	emend.
end point .....	EP
energy .....	$E$
energy (kinetic) .....	$E_k$
energy (potential) .....	$E_v$
enthalpy .....	$H$
entropy .....	$S$
entropy (standard state of) .....	$S^\circ$
ephemeris time .....	ET
equal to .....	=
nearly equal to .....	$\approx$
not equal to .....	$\neq$
equation(s) .....	eq (s)
equilibrium constant .....	K
equivalent .....	equiv.
equivalent conductivity .....	$\wedge$
equivalent uranium .....	eU
equivalent weight .....	equiv. wt.
error function .....	erf
error function (complement to) .....	erfc
Euler number .....	$E$
ex grupo .....	ex gr.
exchange .....	$\updownarrow$
exchangeable-potassium-percentage .....	EPP
exchangeable-sodium-percentage .....	ESP
excited hydrogen atom .....	$\text{H}^*$
exponential of .....	exp, e
factorial product .....	!
Fahrenheit (used with degree symbol) .....	°F
farad .....	F
Faraday's constant (the faraday) .....	$F$



**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

foot, feet	ft
footcandle	fc
footlambert	fL
foot (feet) per second cubed	ft/s <sup>3</sup>
foot-pound	ft·lb
foot-pound-second (system)	FPS
force	<i>F</i>
force (moment of)	<i>M</i>
formality	<i>f</i>
freezing point	fp
frequency	<i>f</i> or <i>ν</i>
frequency (spectroscopy)	<i>ν</i>
friction, coefficient of	$\mu$ or <i>f</i>
Froude number	<i>F</i>
<i>F</i> -statistic for equality of variances	<i>F</i>
fugacity	<i>f</i>
function of <i>x</i>	<i>f</i> ( <i>x</i> )
fusion point	fnp
gallon	gal
gallons per minute	gal/min
gamma function	$\Gamma$
gas, as in H <sub>2</sub> O (g)	(g)
gas constant	<i>R</i>
gas liquid partition chromatography	glpc
gauss	G
Geiger-Müller (unit modifier)	G-M
Gibbs free energy, Gibbs function	<i>G</i>
Gibbs free energy (standard state)	<i>G</i> <sup>°</sup>
gradient	$\nabla$
grain	gr
gram	g
gravitational acceleration, acceleration of free fall, local acceleration due to gravity	<i>g</i>
gravitational constant	<i>G</i>
gray (unit of measure for absorbed dose)	Gy
greater than	>
much greater than	>>
not greater than	≧
greater than or equal to	≧ or ≦
Greenwich mean astronomical time	G.m.a.t.
Greenwich mean time	G.m.t.
gross	gr
gross weight	gr. wt.
half-life	<i>T</i> <sub>1/2</sub>
half-life reduced	<i>fT</i> <sub>1/2</sub>
haversine	hav
head, total	<i>H</i>
heat capacity	<i>C</i>
heat capacity at constant pressure	<i>C</i> <sub>P</sub>
heat capacity at constant volume	<i>C</i> <sub>V</sub>
hectare	ha
height	<i>h</i>
Helmholtz free energy	<i>A</i>

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

henry, henries	H
hertz	Hz
high-pressure (unit modifier)	h-p
high-pressure metal vapor	HPMV
horsepower	hp
hour	h
hydrogen-ion concentration, negative log <sub>10</sub> of	pH
hyperbolic functions, inverse, prefix to be added to abbreviation (for example, arcosh)	ar
hypothesis (alternative)	<i>H</i> <sub>1</sub>
hypothesis (null)	<i>H</i> <sub>0</sub>
identical with	≡
not identical with	≠
imaginary square root of -1	i or j
inch (period may be used if abbreviation might be confused with the preposition "in")	in
inch-pound	in·lb
indeterminate	indet.
index of refraction	<i>n</i>
indices of refraction for biaxial crystals	<i>n</i> <sub>x</sub> , <i>n</i> <sub>y</sub> , and <i>n</i> <sub>z</sub> or $\alpha$ , $\beta$ , and $\gamma$
indices of refraction for uniaxial crystals	<i>n</i> <sub>O</sub> and <i>n</i> <sub>E</sub> or $\omega$ and $\epsilon$
inductance (mutual)	<i>M</i>
inductance (self)	<i>L</i>
infinity	$\infty$
infrared	ir
inside diameter	id
integral	$\int$
integral, closed (circuital or contour)	$\oint$
intensity of X-rays reflected from crystallographic planes	<i>I</i>
intermediate-pressure (unit modifier)	i-p
intersection or logical product	$\cap$
ionization constant	<i>K</i> or <i>K</i> <sub>i</sub>
irrigation-water classification: <i>C</i> denotes conductivity (electrical); <i>S</i> denotes sodium-adsorption ratio (SAR); numbers denote respective numerical quality classes	<i>C</i> 2– <i>S</i> 3
Jackson turbidity unit	Jtu
joule	J
joule per kelvin	J/K
Joule-Thomson coefficient	$\mu$
kelvin (degree symbol not used)	K
kilobyte	K
kilohm	k $\Omega$
kilowatthour	kWh
K-meson	K
knot	kn
lambert	L
langley	ly
Laplacian operator	$\nabla^2$
latitude (abbreviation used only with figures)	lat

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

length .....	<i>l</i>
less than .....	<
much less than .....	<<
not less than .....	≧
less than or equal to .....	≤ or ≤
limit of <i>f</i> ( <i>x</i> ) .....	lim <i>f</i> ( <i>x</i> )
linear alkylsulfonate .....	LAS
liquefied petroleum gas .....	LPG
liquid .....	liq
liquid oxygen .....	lox
liter .....	L
locality, localities (abbreviation used only with numbers) .....	loc (s).
logarithm (common) .....	log
logarithm (natural) .....	log <sub>e</sub> or ln
logical product or intersection .....	∩
logical sum or union .....	∪
longitude (abbreviation used only with figures; omit period when “long” is used with “lat”; use period if abbreviation may be confused with the adjective “long”) .....	long
longitudinal velocity; <i>P</i> -wave velocity .....	<i>v<sub>P</sub></i>
low frequency .....	LF
low-pressure (unit modifier) .....	l-p
lumen .....	lm
luminous flux .....	Φ
lux .....	lx
magnetic-field strength or intensity .....	<i>H</i>
magnetic flux .....	Φ
magnetic induction .....	<i>B</i>
Manning's roughness (resistance) coefficient .....	<i>n</i>
mass .....	<i>m</i>
mean sea level .....	m.s.l.
mass number .....	<i>A</i>
mass number of species <i>X</i> .....	<i>A</i> ( <i>X</i> ) or <i>A<sub>x</sub></i>
matrix; for example $\  a_{ij} \ $ or ( <i>a<sub>ij</sub></i> ) or <i>A</i> .....	$\  \quad \ $ or ( ) or <i>A</i>
matrix, cofactor of element .....	<i>a<sub>ij</sub>A<sub>ij</sub></i>
matrix, conjugate .....	<i>A</i> *
matrix, determinant of; for example $ a_{ij} $ .....	
matrix, identity .....	<i>I</i>
matrix, inverse .....	<i>A</i> <sup>-1</sup>
matrix, transpose .....	<i>A</i> <sup>T</sup>
maximum .....	max
maxwell .....	Mx
mean (statistical) .....	μ or <i>m</i>
mean life .....	τ
mean of a linear combination <i>q</i> .....	μ <sub><i>q</i></sub>
mean of the lognormal distribution .....	α
mean of the negative binomial distribution .....	θ
mean of sample means .....	μ <sub><i>x̄</i></sub>
mean of the variance of sample means .....	μ <sub><i>s<sub>x̄</sub><sup>2</sup></i></sub>

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

mean sea level .....	m.s.l.
mean square error .....	M.S.E.
megabyte .....	Mb
megohm .....	MΩ
melting point .....	mp
member of (used with a set and its elements) .....	ε
meta (in organic compounds) .....	<i>m</i>
meter .....	m
metric ton .....	t
microGal .....	μG
micron .....	μ
mile .....	mi
miles per hour .....	mi/h or mph
Miller indices .....	<i>hkl</i>
millimeter of mercury .....	mmHg
million .....	M
million gallons per day .....	Mgal/d
million years .....	m.y.
minimum .....	min
minus .....	−
minus or plus .....	±
minute .....	min
minute; prime; foot .....	'
mixture melting point .....	mmp
Modified Mercalli .....	MM
molality, molal (concentration) .....	<i>m</i>
molar concentration of substance <i>B</i> .....	<i>c<sub>B</sub></i>
molar mass of substance <i>B</i> .....	<i>M<sub>B</sub></i>
molarity, molar (concentration) .....	<i>M</i>
mole .....	mol
molecular concentration .....	<i>C</i>
molecular weight .....	mol wt
month .....	mo
motorship .....	MS
multiplied by .....	× or ·
multiplying factor for the geometric mean of lognormally distributed observations .....	ψ <sub><i>n</i></sub>
multiplying factor for the variance of lognormally distributed observations .....	φ <sub><i>n</i></sub>
multispectral scanner .....	MSS
muon .....	μ
nabla; del; differential vector operator .....	∇
natural variability .....	ξ <sub><i>n</i></sub>
nautical mile .....	nmi
neutrino .....	ν
neutron .....	<i>n</i>
new genus .....	n. gen.
new series .....	new ser.
new species .....	n. sp.
new variety .....	n. var.
newton .....	N
newton meter .....	N·m
Newtonian gravitational constant .....	<i>G</i>

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

no data .....	n.d.
no record, not reported .....	n.r.
nomen nudum .....	nom. nud.
normality, normal (concentration) .....	<i>N</i>
not available; not applicable .....	NA.
not determined .....	n.d.
nucleon number .....	<i>A</i>
number of observations in a population .....	<i>N</i>
number of observations (sample size) .....	<i>n</i>
number of samples .....	<i>k</i>
observation .....	<i>w</i>
observed frequency of observations .....	<i>O</i>
oersted .....	Oe
ohm .....	$\Omega$
ohm centimeter .....	$\Omega$ -cm
ohm meter .....	$\Omega$ -m
optical directions in a crystal; also rays of light in these directions and pleochroic colors in these directions .....	<i>X</i> , <i>Y</i> , <i>Z</i>
ortho (in organic compounds) .....	<i>o</i>
ounce .....	oz
outside diameter .....	od
oven-dry basis .....	ODB
oxidation-reduction potential .....	<i>E<sub>h</sub></i>
para (in organic compounds) .....	<i>p</i>
parsec .....	pc
part(s) .....	pt(s).
part(s) per billion .....	ppb
part(s) per million .....	ppm
part(s) per thousand .....	ppt or $\%_{\infty}$
partial pressure of oxygen or carbon dioxide .....	<i>P</i> <sub>O<sub>2</sub></sub> , <i>P</i> <sub>CO<sub>2</sub></sub> , or <i>P</i> ( <i>O</i> <sub>2</sub> ), <i>P</i> ( <i>CO</i> <sub>2</sub> )
particle-size diameter .....	$\phi$
partition function .....	<i>Z</i>
pascal .....	Pa
pascal second .....	Pa·s
peck .....	pk
percentage risk of type I error .....	$\alpha$
percentage risk of type II error .....	$\beta$
period .....	<i>T</i>
phase .....	ph
phenyl .....	Ph
phot .....	ph
photon .....	$\gamma$
pint .....	pt
pi (mathematical constant) .....	$\pi$
pion .....	$\pi$
Planck constant .....	<i>h</i>
plus .....	+
plus or minus .....	$\pm$
poise .....	P
Poisson ratio .....	$\nu$ or $\mu$
pooled sample variance .....	$s_p^2$

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

population coefficient of variation and of skewness .....	$\gamma$
population mean .....	$\mu$
population standard deviation .....	$\sigma$
population variance .....	$\sigma^2$
posterior distribution of a parameter $\theta$ .....	<i>D</i> <sub>1</sub> ( $\theta$ )
potassium-adsorption ratio .....	PAR
potential difference .....	<i>V</i> or <i>U</i>
pound (mass) .....	lb
pound avoirdupois .....	lb avdp
pound-force .....	lbf
pound-force per square inch .....	lbf/in <sup>2</sup>
power .....	<i>P</i>
precipitate .....	ppt or $\downarrow$
preparation variability .....	$\xi_p$
pressure .....	<i>P</i> or <i>p</i>
primary wave .....	<i>P</i> -wave
prior distribution of a parameter $\theta$ .....	<i>D</i> <sub>0</sub> ( $\theta$ )
probability of the event <i>A</i> .....	<i>P</i> ( <i>A</i> )
product of a series .....	$\Pi$
proportion .....	:
proportion of successes in a binomial population .....	$\theta$
protium .....	<sup>1</sup> H
proton .....	<i>p</i>
quantity of electric charge or electricity; quantity of heat; quantity of light .....	<i>Q</i>
quart .....	qt
rad .....	rd
radian .....	rad
radiance .....	<i>B</i>
radiant emissivity .....	<i>J</i>
radiant energy .....	<i>Q</i>
radiant energy density .....	<i>u</i>
radiant exposure .....	<i>H</i>
radiant flux .....	$\Phi$
radiant intensity .....	<i>I</i>
radical .....	$\sqrt{\phantom{x}}$
radio detection and ranging .....	radar
radio frequency .....	RF
radius .....	<i>r</i> or <i>R</i>
random fluctuation of "experimental error" .....	<i>e</i>
random access memory .....	RAM
Range(s) (legal land division) .....	<i>R</i> (s).
rankine (used with degree symbol) .....	$^{\circ}\text{R}$
ratio; is to (when solidus is used, the word "ratio" should follow; for example, Cu/Ni ratio) .....	: or /
reactance .....	<i>X</i>
read-only memory .....	ROM
réaumur (used with degree symbol) .....	$^{\circ}\text{R}$
refractive index at 20°C, sodium ( <i>D</i> ) line .....	$n_D^{20}$
relative cumulative frequency .....	r.c.f.
repeating decimal; bar covers part that is to be repeated .....	$1.\overline{14}$

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

resistance .....	$R$
resistivity .....	$\rho$
return beam vidicon .....	RBV
reversible reaction .....	$\rightleftharpoons$
revolutions per minute .....	r/min or rpm
revolutions per second .....	r/s or rps
Reynolds number .....	$R$
roentgen (used with degree symbol) .....	$^{\circ}R$
roentgen equivalent, man or mammal .....	rem
roentgen equivalent, physical .....	rep
root .....	$\sqrt{\quad}$
root mean square .....	rms
rubidium acid phthalate .....	RAP
Rydberg constant .....	$R$ or $R_y$
Rydberg constant for infinite mass .....	$R_{\infty}$
salinity (parts per thousand) .....	$\text{‰}$
sample coefficient of variation .....	$C$
sample mean .....	$\bar{w}$
sample standard deviation .....	$s$
sample variance .....	$s^2$
sampling variability .....	$\xi_s$
saturated calomel electrode .....	see
secant .....	sec
secant, hyperbolic .....	sech
second (time) .....	s
second; double prime; inch .....	"
second-foot .....	s-ft
secondary wave .....	S-wave
section(s) (subdivision of Township and Range) ..	sec(s).
sensu lato .....	s.l.
sensu stricto .....	s.s.
shear velocity; S-wave velocity .....	$v_s$
siemens .....	S
sine .....	sin
sine, hyperbolic .....	sinh
sine of the amplitude (an elliptic function) .....	sn
skewness of frequency distribution .....	sk
sodium, line in spectrum of .....	$D$
sodium-adsorption ratio .....	SAR
solid, as in AgCl(s) .....	(s)
solid angle .....	$\omega$
solidus (also called virgule, slash) .....	/
soluble .....	sol
solution .....	soln
sound navigation and ranging .....	sonar
spacing of Bragg planes in a crystal .....	$d$
species (singular) .....	sp.
(plural) .....	spp.
specific gravity .....	sp gr
specific heat .....	sp ht
specific heat capacity .....	$c$
specific volume .....	sp vol

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

square .....	sq
square centimeter .....	$\text{cm}^2$
square root .....	$\sqrt{\quad}$
standard .....	std
standard deviation .....	$\sigma$
standard error of laboratory means .....	$s_x$
standard mean ocean water .....	SMOW
standard state .....	$^{\circ}$
standard state Gibbs free energy .....	$G^{\circ}$
standard temperature and pressure .....	STP
standardized normal distribution .....	s.n.d.
station(s) (abbreviation used only with numbers) .....	sta(s).
steradian (solid angle) .....	sr
stokes .....	St
strain, normal or linear .....	$\epsilon$
strain, shear .....	$\gamma$
stress, normal .....	$\sigma$
stress, shear .....	$\tau$
subgenus .....	subgen.
subset of; is contained in .....	$\subset$
subspecies .....	subsp.
"Suggestions to Authors" .....	STA
sum .....	$\Sigma$
sum of squares .....	SS
sum of squares of the replication totals .....	$T_r^2$
sum of squares of the treatment totals .....	$T_t^2$
sum total of observations in a sample .....	$T$
surface tension .....	$\gamma$ or $\sigma$
tangent .....	tan
tangent, hyperbolic .....	tanh
temperature .....	temp
temperature, in degrees Celsius .....	$t$
temperature, in kelvins; absolute temperature; thermodynamic temperature .....	$T$
tesla .....	T
theoretical frequency of observations .....	$T$
thermogravimetric analysis .....	tga
thickness .....	$t$ or $d$
thin-layer chromatography .....	tlc
thousand .....	k
thus .....	sic
time .....	$t$
ton, metric (tonne) .....	t
total (grand) of observations squared .....	$G^2$
Townships(s) (legal land division) .....	T., Tps.
trace .....	tr.
trace of a matrix (math) .....	tr
transformed observation .....	$u$
transmittance .....	$T$
triangle .....	$\Delta$

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

trigonometric functions, inverse circular, prefix to be added to abbreviation (for example, arccos) .....	arc
tritium .....	T or $^3\text{H}$
tritium unit .....	TU
triton .....	t
true mean .....	t.m.
ultraviolet .....	uv
undetermined .....	undet.
unified atomic mass unit .....	u
union or logical sum .....	U
unit-cell edges .....	$a_0$ , $b_0$ , and $c_0$
United States (abbreviation used as adjective only) .....	U.S.
United States Geological Survey .....	USGS
U.S. Government Printing Office .....	GPO
United States National Museum (abbreviation used before locality or collection number) .....	USNM
universal time .....	u.t.
Universal Time, Coordinated .....	UTC
Universal Transverse Mercator .....	UTM
vacuum .....	vac
vapor pressure .....	vp
variance, statistic to estimate the variance of lognormally distributed observations .....	$V^2$
variance of quantity $q$ .....	$\sigma_q^2$
variance of lognormal distribution .....	$\beta^2$
variance of negative binomial distribution .....	$k$
variation operator .....	$\delta$
variations; varies as .....	$\propto$
variety .....	var.
velocity .....	$v$ or $u$

**Table 4.** Abbreviations, signs, and symbols for scientific and engineering terms—Continued

velocity of light (in vacuo) .....	$c$
velocity, $P$ -wave .....	$v_P$
velocity, $S$ -wave .....	$v_S$
versed sine .....	vers
versus (standard usage) .....	vs.
vertical angle elevation bench mark .....	VABM
vinculum (above letter; for example, $\overline{w}$ ) .....	—
viscosity, dynamic .....	$\eta$
viscosity, kinematic .....	$\nu$
volt .....	V
voltampere .....	VA
volume, chemical and physical use .....	$V$
volume strain, bulk strain .....	$\theta$
watt .....	W
watthour .....	Wh
wavelength .....	$\lambda$
wavenumber .....	$\sigma$ or $\nu$
weber .....	Wb
weight .....	wt
weight per volume .....	w/v
weight per weight .....	w/w
yard .....	yd
year .....	yr
yields .....	$\rightarrow$
Young's modulus of elasticity .....	$E$

**Prefixes and abbreviations for multiples and submultiples, SI units**

exa ( $10^{18}$ ) .....	E
peta ( $10^{15}$ ) .....	P
tera ( $10^{12}$ ) .....	T
giga ( $10^9$ ) .....	G
mega ( $10^6$ ) .....	M
kilo ( $10^3$ ) .....	k
hecto ( $10^2$ ) .....	h
deka (10) .....	da
deci ( $10^{-1}$ ) .....	d
centi ( $10^{-2}$ ) .....	c
milli ( $10^{-3}$ ) .....	m
micro ( $10^{-6}$ ) .....	$\mu$
nano ( $10^{-9}$ ) .....	n
pico ( $10^{-12}$ ) .....	p
femto ( $10^{-15}$ ) .....	f
atto ( $10^{-18}$ ) .....	a